

Fall 2015

## Tigra scientifica Volume II, Issue 1

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# Tigra scientifica

Science News Magazine



Volume II, Issue I  
Fall 2015



# Foreword

It is our pleasure to welcome readers to the Fall 2015 issue of *Tigra scientifica* Science News Magazine. This is the 10<sup>th</sup> issue in this series of exemplary writings by students enrolled in Clemson University's Creative Inquiry (CI) course, Popular Science Journalism. Science and technology have an enormous impact on society. Thus, science journalists shoulder the responsibility of transmitting accurate, comprehensible, and timely information to bridge the gap between scientists and the general public. A talented group of Clemson University undergraduate students has embraced this responsibility to produce this magazine.

The communication of science to the general membership of a democracy allows for educated decisions in national debates involving science and technology. Without scientific knowledge, it is difficult to know whether to choose wind energy over other forms of energy (page 18), medical treatments based on nanotechnology (page 16), or restaurants that use ingredients from genetically modified sources (page 23). Such knowledge also helps us to understand the natural history of the world (page 9), the behavior of animals (page 7), human culture (page 19) and even the value of a three-day weekend (page 20). In the public realm, scientific knowledge is important in choosing to support (or not support) politicians who favor new efficient fuels, more transparency in medical risk disclosure, or agricultural biotechnology. That these student writers recognize the value of clear science communication is a testament to their maturity.

In developing these articles the students took on four interrelated tasks: to identify the science most relevant to society today, to determine what readers might already know, to design communications to fill critical gaps in knowledge, and to evaluate the clarity of those communications (think late-night group editing). It is unmistakable that these students are profoundly invested in this work and share a deep appreciation for the craft of communicating science. We count it as an enormous privilege to work with extremely talented writers each semester. Since its inception, 48 students have developed more than 255 articles. The course is open to undergraduate students of all majors, ranks, and levels of ability. Students majoring in Biochemistry, Biological Sciences, Environmental and Natural Resources, and Genetics have contributed to this issue.

For us, a central satisfaction of working with these writers has been the opportunity to continually learn new things. It has also been remarkably gratifying to see students expand their writing skills and grow in confidence, camaraderie, and self-awareness. This growth is the result of the format of the course, which was first developed by Dr. Holly Tuten. While a graduate student at Clemson, Holly regularly contributed science articles to the student body newspaper, *The Tiger*. Shortly before graduating, Holly launched the course as an effort to pass her trade on to undergraduate students. We are grateful to Holly for creating a format that was both effective and “turn-key.”

The production of a magazine is always a collective effort. Our heartfelt appreciation goes to Dr. Barbara J. Speziale (Professor of Biological Sciences and Associate Dean of Undergraduate Studies) and the CI Program for encouragement and the funds necessary to complete this project. We are also grateful to Jan Lay (Creative Services Advisor) and Savannah N. Miller (Creative Designer) for their expert assistance in magazine design and layout. Finally, we acknowledge the commitment of past instructors, Mr. Matthew Johnson and Dr. Curtis Newbold, who were instrumental in keeping the project alive.

Although people can choose not to do science, they cannot choose to ignore it. Scientific advances pervade every aspect of life and should be a source of awe, even for people in whom they evoke a sense of disbelief (“wait...we can do that?!”). Science communication is successful when it reaches people with the information that they need in a form that they can use. Through hard work and collaboration, this group of students has increased the accessibility of science to all. We congratulate them on their success.

LESLY A. TEMESVARI, PH.D.

STEVEN B. KATZ, PH.D.

*Executive Editors*

# On the Cover

“The supernova remnant known as Cassiopeia A is the result of an explosion in 1680 of a star that was about twenty-five times as massive as our Sun. When nuclear fuel was exhausted, the core of the star fell in on itself. Some of that matter rebounded to eject the outer parts of the star, and some remained in a neutron star, seen as a blue dot at center, with a density one hundred trillion times that of water. The ejected matter plows into the tenuous interstellar medium at speeds of several thousand kilometers per second, heating it to ten million degrees or more.

“This composite NASA image shows infrared light visualized by the Spitzer Space Telescope as red, visible light visualized by the Hubble Space Telescope as yellow, and X-rays visualized by the Chandra Observatory as blue and green. The oxygen we breathe, the calcium in our bones, and the iron in our blood, among other elements, was made in such explosions prior to the formation of our solar system.”

Mark D. Leising, Ph.D.

*Professor of Physics and Astronomy and Interim Dean of the College of Science at Clemson University*



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A special thanks to Holly Tuten for starting this magazine and helping out with its design.

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# Snakes, From Whence They Came

*Four-legged snake found in South America first in the world*



by Richard Melton

Snakes are one of the most diverse animal groups on the planet, in both the number of species and variety of habitats in which they live. However, little is known about how this legless reptile evolved into what it is today. *Tetrapodophis amplexus*, a fossil found in Brazil earlier this year, provides some answers. Described in the journal, *Nature*, this is a snake fossil with four legs, and it is the first of its kind since most snake fossils only have two legs. This fossil helps scientists understand how leglessness evolved and supports an evolutionary link between snakes and lizards.

One of the debates about the evolutionary history of snakes is from which habitat snakes originated. The two most popular theories are, of a marine origin or an underground origin. This fossil sheds light on the question of origin. For example, if snakes came from a marine environment one would expect certain adaptations to have arisen. These types of adaptations are absent in this fossil which would suggest modern adaptations to marine life came later in the evolutionary history of snakes.

*Tetrapodophis amplexus* also helps explain the function of the fossil legs. Since snakes have developed various forms of locomotion without legs, the fossil legs were probably not used for locomotion. In fact, the researchers that examined the fossil think that the limbs were probably used for holding on to prey rather than for moving. This would mean that snakes eventually lost the need to grip prey, perhaps as they became better adapted to grasp with their elongated bodies, as do modern constrictors. Another discovery was the presence of vertebrae in the body cavity, implying that *Tetrapodophis amplexus* preyed on other vertebrates, a characteristic that is common in modern snakes. This observation gives scientists further insight as to at what point in the evolution of snakes this hunger for vertebrates began.

**“This fossil... supports an evolutionary link between snakes and lizards.”**

Overall the fossil of *Tetrapodophis amplexus* is an extremely important find of evolutionary biologists. It helps answer many of the questions about the evolutionary history of snakes, by showing the direct link between lizards and snakes, a link that had yet to be represented in the fossil record. Additionally, *Tetrapodophis amplexus* gives scientists insight into how early snakes behaved, such as how they hunted, how they moved, and what they ate. This explains many of the characteristics of modern snakes. Though there are many more questions yet to be answered this fossil is an important step in understanding the evolutionary history of our legless friends. 🐾



# Predator or Prey: Proof is in the Pupil

*Scrutinizing the connection between pupil shape and ecological niche*



by Savannah N. Miller

Have you ever noticed in scary movies the villain is portrayed with vertically slit pupils? This distinct feature often gives the antagonist a “creepy” vibe, even if the viewer does not consciously notice it, and science may provide the reasoning behind this unsettling trend. A new study published in *Science Advances* by Martin S. Banks and colleagues has shown that animals’ pupils may indicate whether they are predator or prey in the food chain. The study surveyed 214 terrestrial animals, and it was found that vertical slits are often features of carnivorous animals, like cats, while horizontal pupils are usually characteristic of herbivorous prey, like goats.

“...variations in pupil shape are adaptations that correspond with the animals’ daily needs...”

These variations in pupil shape are adaptations that correspond with the animals’ daily needs, much like any other evolutionary trait. Pupil shape determines how much the pupil can change in size, thus giving the animal a greater ability to adapt to changes in lighting. Elongated pupils can increase in area up to 300-fold allowing ample light into the eye for better vision in dim to dark settings.

According to the study, a horizontally orientated pupil “improves image quality for horizontal contours [defined shapes] in front of and behind the animal and ... also facilitates a horizontally panoramic view for detecting predators approaching along the ground.” These combined characteristics aid the animal in spotting potential threats. According to similar studies, vertical pupils, such as those on animals that ambush their prey, are better suited to maintaining a specific focus and depth of field. This is an evolutionarily significant adaptation, as these animals must measure the distance to their prey accurately before an ambush.

The biological mechanisms for the gradual development of differing pupil orientations are currently unknown. However, it is apparent that horizontal and vertical-slit pupils have coevolved. Coevolution is defined as the phenomenon where a biological adaptation in one species spurs an

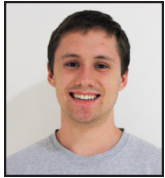
adaptation to evolve in another. For example, bobcats have adapted to have vertically slit pupils that give them a greater ability to spot potential prey, like sheep. In a non-predacious population, the individuals with the best vision are able to spot and evade predators quicker than most. These individuals have a greater chance of surviving predatory attacks and can pass on “good” traits, in this case exceptional vision, to subsequent generations. This pattern likely occurred over time as a response to predation and resulted in horizontally slit pupils, a counter-adaptation to vertically slit pupils, in sheep and other herbivorous species.

In contrast to elongated pupils, circular pupils can only change in area about 15-fold and are controlled by fewer eye muscles. This means that animals that sport circular pupils, like humans, have less pupil control and thus inferior vision due to a lack of light reception in the eye. This is not to say those with circular pupils have inadequate eyesight compared to other animals; they simply do not have a need for such specific visual control in their niche. Thus, science has concluded what screenwriters have known all along: stay away from animals with vertical slit pupils, or their eyes might be the last things you see. 🐾



# Hey... Are We Related?

*Fossils of previously-unknown early hominin species found in Africa*



by Charles Simmons

Looks like Ancestry.com is going to have to update their records, because you have a new ancestor. Well, that is if their records go back a few million years. Your new ancestor belongs to the species *Homo naledi*, a type of hominin that has been extinct for millions of years. Fossils found belonging to this new species of early human are likely to provide invaluable information about the evolution of humans.

Fossils belonging to at least 15 individuals were found in October of 2013 in South Africa, but it wasn't until September of this year that Dr. Paul Dirks and his colleagues announced in *eLife* that these fossils belonged to a new species. Included in the fossils were multiple copies of most of the bones in the skeleton. To put these findings into perspective, researchers are calling this the largest collection of a single hominin species that has ever been discovered in Africa. In order to pay homage to the country where these fossils were found, researchers carefully selected the name *Homo naledi* for this species. The word "naledi" means star in the South African language of Sotho.

**"...researchers are calling this the largest collection of a single hominin species that has ever been discovered in Africa."**

The fossils have already told researchers much about the appearance of *Homo naledi*. *Homo naledi* have hands, arms, feet, and legs similar to modern humans. The ribcage, shoulders, and pelvis also resembled those of modern humans. Where the two diverge is structure of the skull: the skulls belonging to *Homo naledi* were smaller than modern humans and more similar to early hominin species existing two to four million years ago.

Despite the wealth of knowledge already gained from these fossils, there are still many questions that have yet to be answered about *Homo naledi*. One question that remains is the time period during which *Homo naledi* lived. The only clue that researchers have so far is the aforementioned skull structure, suggesting that *Homo naledi* lived two to four million years ago. Researchers hope to find additional clues to get a more accurate estimate of the time period during which *Homo naledi* roamed the earth. Researchers are also wondering why there were so many individuals buried in one location. Using geographical and taphonomic (related to the processes affecting fossilization) clues, Dirks and colleagues believe that the site was used for body disposal. Other possible explanations include mass fatality, a death trap, or being a place where predators of *Homo naledi* would bring the scavenged remains of the early hominins.

Although many questions remain regarding your newly discovered ancestor, *Homo naledi* has already revealed many clues about the evolution of modern humans. The discovery of over 15 specimens could prove to be one of the most valuable archaeological finds of all time. 🐾



# Wait, I Thought it was an Asteroid?

*Impact may have intensified volcanic eruptions that killed the dinosaurs*



by Richard Melton

Since childhood we have all had a love of and fascination with dinosaurs, and most of us were taught that these reptiles ruled prehistoric earth until they went extinct due to a large asteroid collision with the earth some 65 million years ago. This extinction led to the rise of other animal groups. However, new evidence might show that this story isn't completely correct. In fact, a study published in *Science* shows that volcanic activity on a global scale actually started this mass extinction, which was previously thought



to have been caused by the asteroid. This volcanic activity may have started many years before the asteroid struck the Earth. An estimated hundred thousand years before the asteroid hit. The asteroid subsequently intensified the volcanic activity. Radiometric analysis of newly found rocks were used to determine the sequence of events that led to the end of the dinosaur reign.

**“This volcanic activity may have started many years before the asteroid struck the Earth.”**

The previous theory of this extinction was that a asteroid hit the earth and caused massive volcanic activity which wiped out most of Earth's terrestrial life. New evidence presented by Paul R. Renne and colleagues supports the idea that the asteroid hit after the volcanic activity had started. This idea was proposed when scientists dated rocks found in the Deccan trap, a lava field in India. The rocks were estimated to be 66 million years old. Samples from before, during, and after the extinction were taken, and they showed that the output of lava nearly doubled within 50,000 years of the asteroid impact. Since events like this are rare, it is most likely that the asteroid impact played a huge role in causing this global problem.

Because the two events happened in quick succession (geologically speaking), it is unknown which had the bigger impact on the dinosaur extinction. Scientists think that the effects of either of these events individually would have been similar to the effects from a combination of the events. Had the time of the two events not been so close, life on earth could have turned out very differently than we see it today or could have quite possibly been completely wiped out.

Further study is needed to determine the specific sequence of events that led to the dinosaur extinction occurrence. The study gives much needed insight into how the reptilian kings we have come to love lost their hold on the planet and soon after vanished into extinction, which led to the rise of other animal groups and the beginning of the mammalian reign. 🐾





# Clever Cephalopods

*New discoveries in the octopus genome may be linked to species' abnormal intelligence*



by Maggie Masterson

With thousands of little suction cups, eight legs, and one unusually large brain, the octopus is unlike any other animal. These ocean-dwellers are versatile, flexible, and intelligent, leaving scientists to ponder what evolutionary machinations created such a unique organism. Octopuses have demonstrated their abilities to complete mazes, solve problems, and even utilize tools—feats which other members of their phylum are not capable of accomplishing. Sequencing of the octopus genome is giving scientists insight about why our eight-legged friends are smarter than the average mollusk.

Understanding the octopus genome has helped scientists elucidate the origin of the cephalopod's abnormal intellect, as described in *Nature*. Researchers at the University of Chicago were shocked to learn that the octopus genome is nearly as large as the human genome. It also encompasses a greater number of exons, or protein-coding regions, than the human genome does. Additionally, many of these exons encode proteins for the development of neurons and their interactions. Octopuses have a very advanced nervous system, so it seems logical that many of their genes should dictate the structure of neurons and related fibers. With half a billion neurons, octopuses are six times more advanced than mice in terms of neural pathways, allowing them to easily manipulate their surroundings. Several genes coding for proteins known as reflectins were also identified. Reflectins allow light to bounce off an octopus's skin, allowing it to camouflage and disguise itself.

**“Scientists are postulating that these protein systems are the reason octopuses can readily adapt their neural-network.”**

But the most interesting genomic discovery was a system of rapidly modifying proteins. These proteins have the ability to change their function, and the purpose of their surrounding tissue, very quickly. Scientists are postulating that these protein systems are the reason octopuses can readily adapt their neural-network, facilitating their extraordinary learning abilities and memory functions. This would be best confirmed by genomic sequencing of other mollusks, and comparing the results.

While the octopus genome revealed a few surprises, there are likely many more secrets within the genome that we haven't yet uncovered. There is a great deal that we don't yet understand about genomics, and the genetic basis of intelligence. Nevertheless, this research is a huge step in the right direction. The octopus is an uncommonly complex invertebrate, and learning more about the molecular basis of its unusual abilities will help scientists understand more about other species as well. 🐾

# Stress for the Figure

*Could adrenaline be the key to effective weight loss?*



by Hannah Halusker

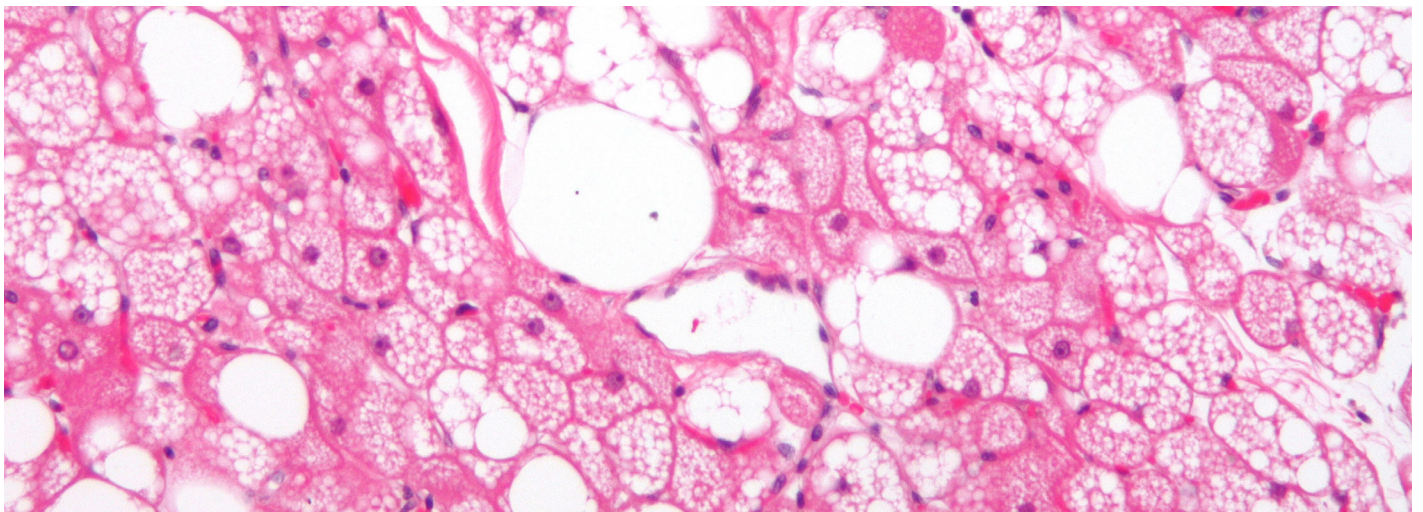
If working up a sweat on the treadmill at the gym is not your idea of a fun workout regimen, scientists may have discovered a solution for you. All it takes is some sort of physical trauma to kick-start your body's adrenaline response. Researchers at the University of Texas Medical Branch in Galveston conducted a study on 48 child and adult victims of third degree burns and discovered that some of the fat in their bodies transformed from white adipose tissue to brown adipose tissue. This tissue burns more calories and generates more heat than white tissue. Adrenaline, a hormone that is secreted in response to stress, is believed to have acted on burn victims' fat cells to stimulate this transformation.

Brown fat, which has an abundance of dark-hued, high energy mitochondria, is important to generate heat in infants who cannot yet shiver to warm themselves. It was originally thought that this brown fat disappears after infancy. However, in recent years, brown fat has been discovered in the neck, shoulders, and spinal cord of adults, prompting scientists to study its possible applications for curbing weight-related diseases. A number of studies have shown that shivering during exposure to extremely cold temperatures can trigger the change of white fat to brown fat in mice, ultimately burning hundreds more calories every day.

**“Adrenaline...acted on their fat cells to stimulate this transformation.”**

In the current study, published in *Science*, it was postulated that burn victims, having lost their skin, converted white fat to brown fat to retain heat and maintain their weight during the recovery process. Dr. Labros Sidossis and his team of researchers believe adrenaline is the hormone that activated the fat conversion, though they're not the first to cite the connection. Animal studies, like those performed on mice, have shown a correlation between adrenaline and brown fat as well.

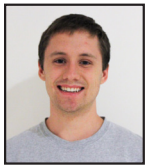
“The next step is to find the mechanism,” says Sidossis. His team is now monitoring the burn patients, to see how long the high-energy brown fat remains before its cells begin to degrade. They're also trying to determine the molecular mechanism that regulates the pathway for a white-fat-to-brown-fat transformation. Once the mechanism is understood, a drug can be developed that would help combat obesity. In targeting obesity, many other weight-related illnesses could be managed, such as high cholesterol and diabetes. Unfortunately, until that drug is formulated, regular dates with the gym and a nutritious diet are your best bets for shedding the pounds and staying healthy. 🐾





# Man's New Best Friend

*Over 60 genes altered in pigs in hope of transplanting organs into humans*



by Charles Simmons

Each and every day, an average of sixteen people in the United States die waiting for an organ transplant. This number could soon be lowered significantly, thanks to an unlikely source: pigs. Dr. George Church of Harvard Medical School has cofounded a company that is working to modify genes in pigs to allow the human body to accept porcine-derived (pig-derived) organs. Church and colleagues announced at a US National Academy of Sciences meeting on October 5<sup>th</sup> they have modified over 60 genes in porcine embryos that could cause disease in humans, and modified additional genes in separate porcine embryos that could trigger an immune response in humans.

Aortic valves, structures that separate the heart and the aorta (the artery that sends oxygenated blood from the heart to the entire body), from pigs have been transplanted into humans since 1969. The use of these valves does not pose the same challenge as using whole organs. Valves are unlike organs as they are mostly non-vascular, meaning they do not have much blood flowing through them; therefore, they are not highly exposed to the immune system, the system that causes rejection.

**“...they have modified over 60 genes in porcine embryos that could cause disease in humans...”**

So how can porcine organs just be inserted into humans? Although the sizes of porcine organs are comparable to human organs, the porcine genome encodes for many porcine, porcine-derived, endogenous retroviruses (PERVs). PERVs are viruses that are embedded in the porcine genome and cannot be neutralized. Retroviruses are particularly dangerous since they integrate their genetic material into random places in the host genome, possibly interrupting important gene functions. Seeing as PERVs cannot be neutralized or treated, the best possibility to make the transplant viable is to delete the genes coding for the PERVs. In addition to the retroviruses, proteins on the surface of porcine cells called antigens can cause blood clotting and trigger an immune response in the human host.

To delete the necessary genes, an innovative molecular biology technique, dubbed CRISPR, was employed. CRISPR allows for researchers to quickly and cheaply alter the DNA of almost any organism. The challenge to create both sets of deletions in a single embryo lies ahead of the researchers, which they note is necessary for pigs intended for organ transplants.

If pigs can help save an average of 16 lives per day, they may surpass dogs as man's true best friend. 🐾



# A Path to Cure Neurological Disorders?

*Using neuron development to unlock secrets about neuron-sourced diseases*



by Alex Villano

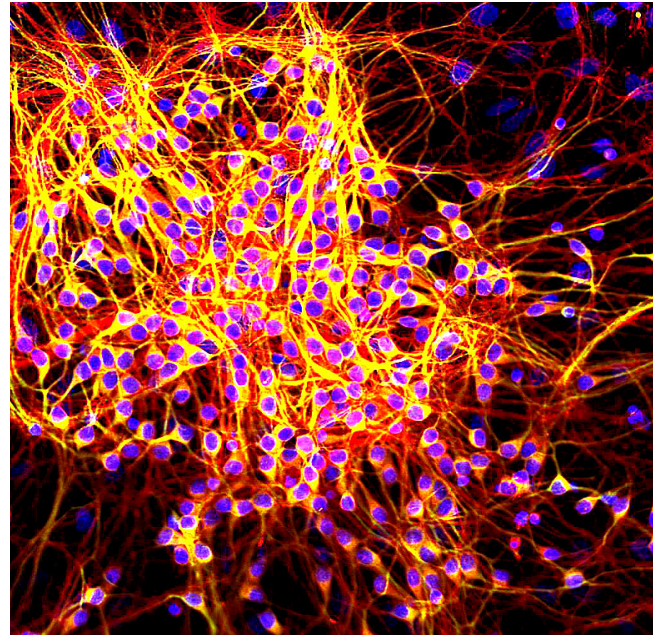
The importance we place on maintaining a healthy brain is no secret. So while you are anxiously finishing today's puzzle to maintain your brain health, look no further for the answers to the great mysteries of this vital organ than—a mini brain? It is accepted that healthy lifestyle choices prevent diseases such as Alzheimer's and Parkinson's, but we are still naïve to the biological processes occurring within

**“...effects on organoid structure and function can be observed that mimic those in the collective neuronal networks of patients with respective neurological disorders.”**

the brain that lead to such neurological states. In a lab at the Institute of Molecular Biotechnology in Vienna, Austria, Madeline Lancaster and Jürgen Knoblich have paved the way for human pluripotent stem cells—cells that can become any cell in the body—to generate neuron clusters in a petri dish that closely resemble miniature human brains. Less than a year ago, the researchers published their findings of neuron clusters in *Nature Protocol* to demonstrate that with their small size and paralleled structure and function to neuronal networks within the brain, effects can be seen that are otherwise hidden in the skulls of patients with neurological disorders such as autism, Alzheimer's, and Parkinson's.

When grown under laboratory conditions, these mini brains arise from a single pluripotent stem cell that mitotically divides, creating numerous differentiated neurons. Collectively referred to as cerebral organoids, these masses of nerve cells mimic the structure of fetal brains during development within the womb, even creating fluid-filled cavities much like the brain's ventricles. Two months are required to grow the organoids to a size large enough to monitor, while these structures can be maintained for up to a year for results to be documented.

To navigate around controversial issues involving stem cells from embryos and fetuses, the researchers employ a process known as induced pluripotency. By taking adult skin cells, a readily available source, researchers reverse their maturity and lead them down the path to instead become nerves. Because these organoids closely mimic the structure and function of tissue within the human brain, they can now place them in manipulated environments similar to those of neurons within brains that produce Alzheimer's and Parkinson's diseases. Through this process, effects on organoid structure and function can be observed that mimic those in the collective neuronal networks of patients with respective neurological disorders.



So, while we applaud the completion of puzzles in the name of brain health, there is imminent information on the horizon bringing us closer to understanding and finding cures for diseases developed from neuron malfunction. This will close the gap on the great mysteries housed within the brain. 🐾

# The Negative Outcomes of a Positive Result

*New genetic tests may provide more stress than information for patients*



by Maggie Masterson

The rise of genetic testing has led to thousands of women undergoing BRCA testing in the past 15 years, but novel gene mutations are leading to a more expansive and more controversial test. BRCA is a gene that protects us from developing tumors, so a mutation on BRCA implicates a high risk of cancer, but it is not the only gene linked to hereditary cancers. Women are now opting to undergo panel testing, which involves not only testing for a mutation on the well-known and extensively understood

BRCA gene, but also on newly discovered genes, about which geneticists are still at a knowledge deficit, as reported in *Reuters*.



A mutation in either the BRCA 1 or BRCA 2 gene will greatly increase a person's lifetime risk of breast and ovarian cancer. The lifetime risk of developing breast cancer for someone with a BRCA mutation is up to 87 percent, and up to 44 percent for ovarian cancer. Women are the highest risk group for these cancers, since they have more breast tissue than men, and because only females possess ovaries. For this reason, it is mainly women who opt for BRCA testing, although men can also be screened to assess their status as a carrier of the gene. However,

there are women developing hereditary breast cancers who test negative for a BRCA mutation, indicating that there are other genes linked to these hereditary cancers. This is where genetic panel testing comes into play.

**“The catch with these novel genes is that their expression and relative risk to certain cancers are mostly unknown.”**

A genetic panel test differs from a normal genetic test in that it will screen many genes rather than just targeting one. For example, an Ambry Genetics BreastNext panel test will screen for a mutation in BRCA 1 or 2, as well as on fifteen other genes linked to breast cancer, such as PALB2 and TP53. A test that provides more genetic information should lead to better medical management and risk assessment, right? Well, the catch with these novel genes is that their expression and relative risk to certain cancers are mostly unknown. A woman who would have previously breathed a sigh of relief over a negative BRCA result may now be burdened with the information that she has a mutation on a gene such as TP53. Genetic counselors cannot articulate the exact risks that accompany such mutations and, more alarmingly, cannot confidently say that a mutation in one of these genes is malignant. The genes in question are so new to us that testing for them may cause more harm than good.

We are continually gathering more information about these new genes, which is one benefit of these controversial panel tests: they are slowly helping geneticists learn more about these novel genes. But for now many geneticists are calling for a moratorium on these tests, until more clinically relevant information is available. As time passes, it will become more clear if genetic paneling is helping or hurting patients. 🐾



# Bottled Benefits

*Isolating exercise-related kinases in a cocktail to reap benefits without physical activity*



by Alex Villano

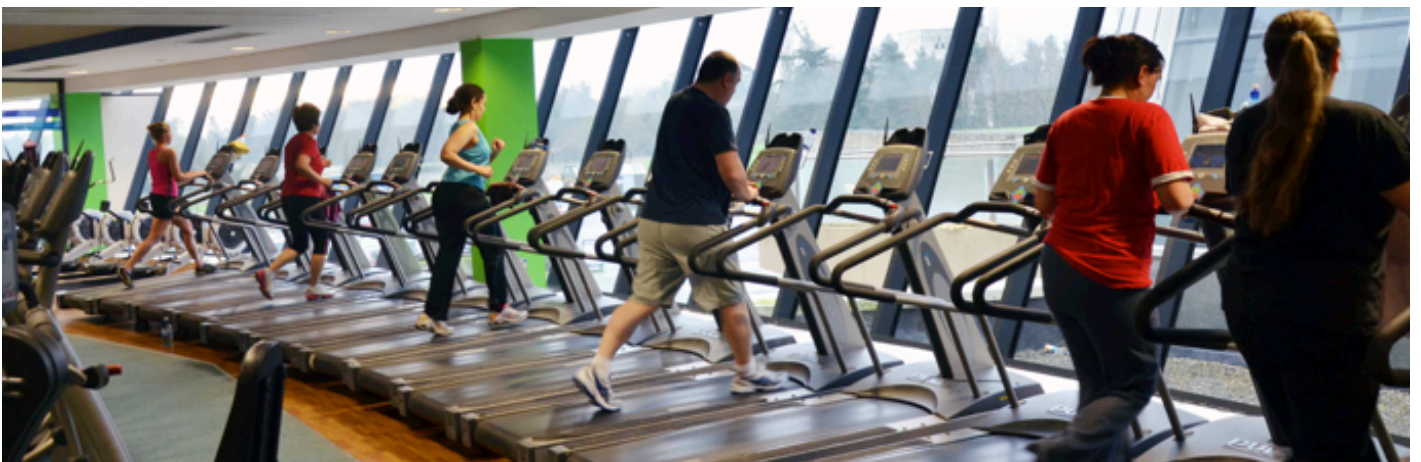
We encounter them everyday on sidewalks around town and in public gyms: exercisers. While their main goal may be to maintain their nice figure and fight obesity, those who are exercising are also maintaining good metabolism to try and prevent diseases such as type II diabetes. But, what if the time spent exercising could be put to other uses while still reaping the same benefits? Scientists have uncovered a pathway to bottling key products used by our muscles to maintain a healthy metabolism so that hours spent exercising can be spent elsewhere in life. In the October issue of *Cell Metabolism*, Dr. Nolan J. Hoffman, from the University of Sydney in Australia, and his colleagues describe a group of specific kinase proteins, functionally known as enzymes, and how they accumulate in muscle cells after exercise.

**“Scientists have uncovered a pathway to bottling key products...so that hours spent exercising can be spent elsewhere in life.”**

Faced with the challenge of finding which kinases promote the benefits of exercise in muscles, Hoffman’s team analyzed two muscle tissue biopsies from each male test subject: one prior to

the strenuous exercise routine and one following the routine. This experiment was made challenging by the numerous signaling pathways that are activated in a muscle cell during exercise, each of which may rely on different kinases. Such pathways include the integration of extracellular signals that allow the cell to produce particular proteins in response. The experiment led the scientists to the discovery of over 900 new sites in which kinases are activated within muscle cells, which may be responsible for the well-known metabolic benefits of exercise. While muscle responds to exercise with a series of kinases, it is not the only tissue within the human body that relies on kinases. Because of this, the study lays the foundation for future hypotheses that wish to investigate kinases and their respective signaling pathways occurring in other tissues.

Knowledge of such kinases in more tissues of the body will help to create a “cocktail” of these enzymes that Hoffman and colleagues hope can be bottled and sold to consumers to simply drink and consider themselves exercised. While some enjoy the post-exercise euphoria, a product such as this kinase mixture would make obesity and diseases such as type II diabetes a thing of the past for those who do not exercise on a daily basis. In a society that feels the pressure of time, this could help alleviate having to squeeze in time for exercise in such busy schedules. For those unable to exercise due to physical handicaps, this could be the answer to maintaining a healthy metabolism. The dawn of a new age is approaching to bottle the benefits of exercise without the sweat. Would you buy into it? 🐾





# Tiny Medicine, Big World

*Disguising nanoparticles inside blood fragments may be the key to evading the immune system*



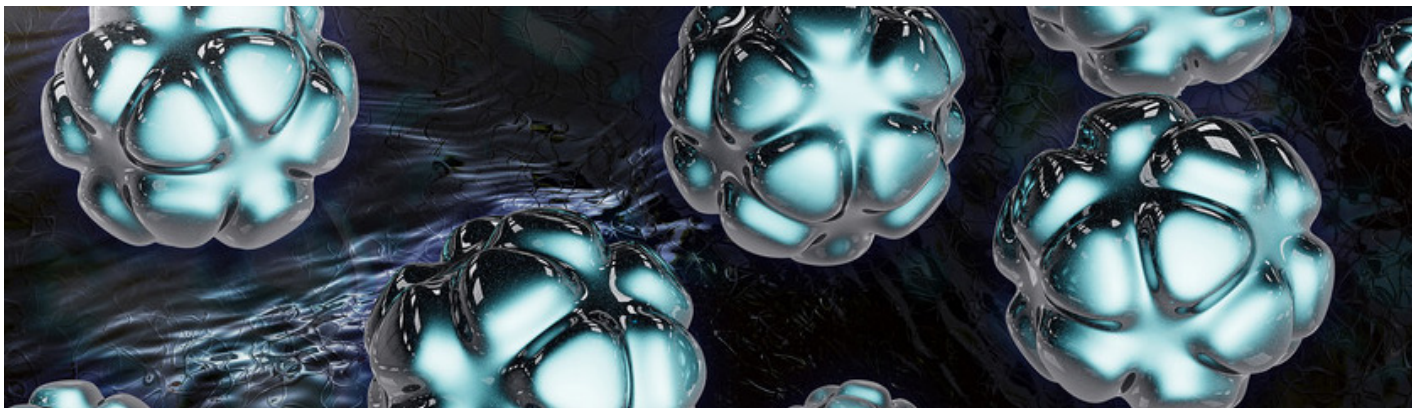
by Maggie Masterson

Nanoparticles have been investigated for years by scientists looking to revolutionize biotechnology, to little avail. The problem? Our immune system is incredibly effective at recognizing and destroying foreign particles, including medically-engineered nanotechnology. Nanoparticles could have fantastic effects on healthcare, such as transporting drugs on the molecular level, but they are frequently destroyed by our immune system, rendering them ineffective. As a solution to this problem, nanoparticles are now being cloaked in cell fragments so that the body does not attack them as foreign invaders, according to *Nature*. This new method of disguising nanoparticles may be the key to tricking the body's immune system.

**“...nanoparticles are now being cloaked in cell fragments so that the body does not attack them as foreign invaders...”**

Platelets are an essential component of blood that allow clotting. They are composed of cytoplasm fragments and lack a nucleus. Scientists at the University of San Diego determined that these platelets were ideal for concealing nanoparticles, since they are a natural part of blood circulation in the body. They are able to protect nanoparticles by avoiding macrophages, white blood cells that usually destroy the particles by engulfing them. Researchers have previously tried attaching nanoparticles to proteins, but had little success. These platelet experiments mark the first time that nanotechnology has shown success in tricking the body's defense system, because the platelets have a wide variety of membrane proteins, facilitating interactions with other cells. The platelets naturally interact with damaged tissue based on their tendency to clot wounds, which is where the nanoparticle medicine would need to be administered. Not only are these hidden particles able to elude the immune system, but they also take advantage of the ability of platelets to repair wounds. Therefore, these platelet-coated nanoparticles are doubly effective, healing damage and delivering drugs.

However, this method of nanoparticle cloaking is not without inaccuracy. Many scientists are questioning if the particles are healing at a truly effective level, because many platelets were found in test animals' liver and kidneys. This indicates that the particles were quickly being broken down in these organs and removed from the circulatory system. The team at University of San Diego says they will need to test the nanotechnology on larger animals before determining how to use it best on humans. Despite these drawbacks, Omid Farokhzad, a nanotechnologist at Brigham and Women's Hospital, embraces the technique with enthusiasm, saying, “I think the promise is huge.” The technology is developing quickly and gaining effectiveness, so next time you need drugs delivered through your bloodstream, nanoparticle treatment could be your best option! 🐾



# Becoming a Solar Sensation

*The invention of the outer space cemetery*



by Hannah Halusker

It's a cool autumn evening, and you are admiring the night sky from a blanket in your backyard. The stars are shimmering, the moon is bright, and you look toward the east to see a shooting star soaring through the sky. This isn't a typical shooting star, though—it's a memorial to a local family's loved one whose ashes are becoming one with space. With the help of the California-based company, Elysium Space, shooting star burials and other galactic resting places are becoming realistic alternatives to the cemeteries found here on Earth.

As recently reported in *Science*, line of celestial services in Summer who have been in the business for have built their reputations on care, having combined the two technology. The memorial begins kit in the mail, which contains Cremated remains are then placed sent back to Elysium Space to be modules until the memorial's

**“...shooting star burials and other galactic resting places are becoming realistic alternatives to the cemeteries found here on Earth.”**

Elysium Space announced their 2015, now rivaling Celestis Inc., the past 18 years. Both companies aerospace engineering and funeral to provide this revolutionary as Elysium Space sends a burial a capsule made of aluminum oxidized film for space travel. in the capsule, and the capsule is sorted into respective spacecraft launch date.

For as little as \$1,990, the capsule is sent into space to be honored in a variety of places. Elysium Space's Shooting Star Memorial launches the capsule into Earth's orbit, where it continues its revolution until falling to the atmosphere as a shooting star. On the other hand, the capsule could be buried on the moon's surface in what Elysium Space calls their Lunar Memorial. The last option offered is the Milky Way Memorial, which propels the capsule into deep space, beyond our own solar system, where it is able to traverse the universe for the rest of time. To distinguish themselves from Elysium Space, the rival company Celestis Inc. markets one additional service in which the capsule is sent into space, only to return to Earth after its flight. The remains can then be recovered by the family and cherished in remembrance.

In 1997, Celestis Inc. had their first spaceflight—The Founders Flight—which carried Star Trek creator Gene Roddenberry and American psychologist Timothy Leary. Since then, Celestis Inc. has laid to rest many astronauts, sci-fi actors, physicists, and everyday people, and now Elysium Space will, too. Anyone can opt for one of these celestial burials—the only requirement is a few thousand dollars and a dream to become a solar sensation. 🐾

# Blown Away by New Technology

*Scientists and entrepreneurs search for viable new technologies to capture alternative energy*



by Annie Carew

If you have ever driven through the Midwestern United States, you have seen a wind turbine. They rise majestically from the prairie like enormous trees, their blades turning sedately in the persistent wind. The aesthetic effect of an entire “farm” of wind turbines is one of serenity and futuristic technology. The wind energy that is potentially available could go a long way towards solving the imminent energy crisis. Wind farms in Kansas, for example, currently generate nineteen percent of the state’s electricity, and the state has the capacity to generate seventy-five percent of the electricity used by the entire nation. Texas’s untapped wind potential is even higher.



However, there are drawbacks to wind power. Turbines are expensive to make, assemble, and maintain; there are a number of parts that can break or malfunction at any time. Furthermore, conservationists are concerned about bird and bat fatalities caused by wind turbines. A study conducted by the University of Delaware in 2011 estimates that a single wind turbine caused eighty-two avian deaths in eleven months.

A startup company in Spain has recently proposed a wind turbine design that will theoretically solve both of these problems. The Vortex Bladeless is deceptively simple. Its creator has compared its appearance to a stalk of asparagus; since there are no blades, the Bladeless does not oscillate in the wind. Instead, it takes advantage of the natural activity of wind moving around an object. As wind moves around the tall, slightly coned structure, the swirling of the wind causes the “turbine” to vibrate. These vibrations are then converted into electrical energy by a generator in the base of the turbine.

**“The wind energy that is potentially available could go a long way towards solving the imminent energy crisis.”**

There are several reasons why the Vortex design could be much better than the traditional turbine. Firstly, this design will be easier to maintain than the old style of turbines since it has only one piece. According to the company’s website, the single piece also eliminates the risks of friction between moving parts. The company estimates that a large Bladeless operating at full capacity can produce one million watts of electricity in a year. The average US home uses 10,000 kilowatts per year; thus, a single Bladeless turbine could power 10 homes for a year. While current studies are focused on the electrical function of the Bladeless, it seems likely that the lack of turbine blades could reduce bird and bat casualties.

Vortex Bladeless is still in its infancy, and further studies must be conducted on the design and its environmental impacts before any solid conclusions can be drawn. However, the genesis of such new technologies bodes well for the future of alternative energy. If innovation continues in this fashion, the energy industry could be entirely transformed in our lifetime. 🐾



# 0 to 100... Not so Quick

*How cultures developed higher numbers*



by Hannah Halusker

Do you remember when you were in second grade, and you began to count numbers in patterns? Your teacher would have a number line in intervals of 10, and the students would shout in unison, “10, 20, 30!” each time her pointer landed on a number. But, how did your teacher know to teach you numbers in 10’s? Why did you have to learn how to count that high, anyway? Yale University historical linguist Claire Bower and her undergraduate researcher Kevin Zhou set out to answer precisely that question. In the September 2015 issue of *Proceedings of the Royal Society B*, Bower and Zhou revealed that the Pama-Nyungan language family of Northern Australia added higher numbers to its system for practicality.

For many cultures, higher numbers are not necessary: their people can count on their fingers and use variations of words like “many” to account for numbers beyond ten. This method works for these cultures because they do not think in quantities but rather in shapes or names. For instance, an Amazonian mother knows she has all of her children in her vicinity not by counting them one by one, but by naming them until they’re all present; a shepherd takes inventory of his sheep by judging the form they make when they are ushered into their paddock.

When an Amazonian merchant begins trading with a nearby tribe that he’s never met before—that’s when higher numbers arise. He isn’t familiar with this tribe, and therefore does not trust them, so a record of their transaction needs to be tracked meticulously. Dr. Patience Epps, a linguist at the University of Texas-Austin, explains that this is how modern languages began building their number systems many millennia ago.

“...they do not think in quantities but rather in shapes or names.”

The Pama-Nyungan language family became the perfect dataset for studying number systems, as it encompasses 300 languages spoken by about 25,000 people, many of them being Aboriginal Australians. Most of the 300 languages have number systems that stop at 3, 4, or 5. Dr. Bower used a computer model to reconstruct how the numbers evolved over 6,500 years, and then created a family tree of the languages to track which numbers were added and which were lost in evolution. She and her team concluded that, although some of the languages had lost a number or two over time, most of them had gained numbers. As opposed to adding numbers sequentially (i.e. 1, 2, 3), they added numbers in clusters (i.e. 5, 10, 20). Dr. Bower attributes this gain to practicality: if you need to count to five, you’ll probably need to count higher than ten, too. She also notes that it became easier for cultures to fathom an infinite number system as they added more numbers to their vocabulary. So, the next time you find yourself counting \$10 bills from your handsome paycheck, will you appreciate your second grade teacher and your distant ancestors who made the number 10 possible for you? 🌸



# Three-Day Weekends Commence

*Evidence from school districts support the four-day school week*



by Alex Villano

Students of all ages love the idea of only going to school four days a week. Although scoffed at by most of the higher-ups in the school system, this long-time dream of many students now has the support it needs to become a reality. In the 2015 summer issue of the *MIT Press Journal*, Dr. Mark Anderson and Dr. Mary Beth Walker of Montana State University and Georgia State University, respectively, published a study which compared elementary school standardized test scores from Colorado districts housing both traditional and four-day school week schedules. Conclusively, the odds look better than were anticipated when it comes to student achievement improvements.

Across the nation, school districts are scrambling to find new and innovative ways to cut costs across the board without compromising student success in the classroom, thus fueling the research of Anderson and Walker. While researchers have previously conducted case studies, no mathematical correlation has been done to show how the four-day schedule impacts students in the classroom. In 2008, seventeen states within the U.S.

**“Across the nation, school districts are scrambling to find new and innovative ways to cut costs across the board without compromising student success in the classroom...”**

reportedly had districts implementing the four-day school week, with Colorado reporting 60 out of 178 districts on the non-traditional path. The four-day schedule included better student and teacher attendance—expected to enhance student performance, as well as allowing the fifth day to be used for personal medical appointments and school events that would otherwise take up the traditional school day. Negative prospects also lingered: teachers had increased stress and fatigue from working longer days. Also, there are greater possibilities for teens to engage in criminal activity with an extra day off. Most notable was the question of whether students’ classroom success would be hindered by the schedule change.

Anderson and Walker attempted to answer this question by taking averages for reading and math scores. Traditional schools indicated 66.9 percent and 63.2 percent of students scoring either proficient or advanced on these tests, respectively, while four-day schools indicated 66.1 percent and 60.3 percent scoring proficient or advanced for reading and math, respectively. While traditional schools included over 8,000 test scores, four-day schools only included about 600 test scores, therefore leaving a large gap about what contributed to the slight decrease in test scores among the compared schools. When using a subset of schools who switched from traditional to four-day schedules during the data collection period, it was found the test scores were significantly higher after the schedule switch occurred: 60.8 percent reading and 53.2 percent math averages before the switch to 71.0 percent and 72.0 percent reading and math averages, respectively, after the switch. Switched schools acted as controls, and evidence built to support a positive correlation between the four-day schedule and improved student performance in the classroom. Those students, while changing from year-to-year, have the same academic environments to dwell in with only the amount of time spent in the classroom on a particular day changing.

So, now that we have the chance to change the future of education with this cold hard evidence, start sending copies to your local legislatures and school administrators. Backed by mathematical reasoning, how could such a change be the wrong one? 🐾







# The Value of a Dollar

*Men and women express differences on what money means symbolically*



by Savannah N. Miller

It's no secret that men and women express differences in behavior. In general, women tend to be more sentimental and nostalgic, and some associate meaning with seemingly insignificant objects; for example, some mothers keep the hair from their child's first haircut. Men, in contrast, are often less attached to material items. A recent study published in *Nature* by Furnham and colleagues found that this same trend exists in regards to money: women associate money with love and friendship, whereas men associate money with freedom and independence.



In this study, 109,472 participants completed a survey via BBC online. About 46 percent of those surveyed identified as male and the rest were female. The mean age of the participants was about 40 years old, and most of them were Caucasian. The questionnaire was 20 questions long, consisting of yes or no questions like, "Do you hold onto, or hoard your money?" "Do you often gamble and spend large sums on your bets?" "When you ask for money are you flooded with guilt or anxiety?" and "Do you spend money on others but have problems spending money on yourself?" These questions aimed to reveal how participants viewed money, and assumptions about the individuals were deduced based on their answers to the questions.

The results of the survey showed that the women surveyed tend to associate money and monetary issues with feelings and emotions. They were more inclined to be generous with money, and used it to buy "tokens of love, esteem, and friendship." The women also used money as an emotional outlet and frequently engaged in binge spending and "retail therapy." The study assumed that generosity

and affection were associated with feelings of love, and it therefore concluded that women associate money more with love. In contrast, the men surveyed associated money with power and security, equating money to personal independence and the ability to achieve goals. In other words, men who participated in this study saw money as a means of accomplishing tasks and gaining success.

Though the results of the survey were significant and visibly portrayed the differences in how the sexes perceive money, they were not conclusive. The sample size was small, pertaining to almost exclusively white individuals from England.

done by Dew and in 2012 by the Family Relations disagreements predictors of couples. Spouses opposing views well in the long

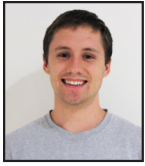
**"...women associate money and items with love and friendship, where men associate money with freedom and independence."**

A related gender study colleagues published National Council of found that financial are one of the highest divorce in married with dramatically on finances did not fare run; the study reported

that dissimilarities in financial preferences prevented spouses from feeling like a true couple. So, even though men and women in general may have some disagreements on what "money" really means, it is probably in a person's best interest to find a companion that has similar views to theirs on the matter. 🐾

# The Economy, Immigration... GMOs?

*New research sheds light on controversial topic of GMOs*



by Charles Simmons

Genetically modified organisms (GMOs) have become one of the most controversial issues in today's society. With the 2016 presidential election approaching, this issue is likely to arise in debates, as opinions among candidates and the public is not uniform. GMOs have been portrayed in a negative light as of late, as Chipotle recently became the first national restaurant chain to cook with only non-GMO ingredients, and as Senator Bernie Sanders recently proposed a bill in Congress to allow states to require companies to label food products made with genetically modified ingredients. However, a recent study has found that genetically modified crops are actually good for the environment, since they require fewer pesticides.

The study, published in *Nature* by researchers at the Chinese Academy of Agricultural Sciences, found that planting crops that are genetically engineered to produce toxins that poison pests were able to cut pesticide usage to half from 1997 to 2012. The plant, Bt cotton, contains a gene from *Bacillus thuringiensis* (Bt) that codes for endotoxins that are toxic to many pests, especially cotton bollworms.

You may not have heard of Bt cotton before, but it's likely to be in everything that contains cotton, from blue jeans to furniture. Not only have Bt cotton crops reduced pesticide use by half, but also the number of predators - namely spiders, lacewings, and ladybirds, that prey on agricultural pests have doubled in this time frame.



So how do crops designed to be toxic to some pests affect the population of other pests who are not affected by the new toxin? Those against the use of crops genetically modified to require fewer pesticides hypothesized that by reducing pesticide usage, pests unaffected by the toxins produced by the plant would go through a population boom, which would require extensive spraying. It turns out that this was not the case, as the rise in predator population was able to compensate for the reduction of spraying. The researchers behind this study point out that the genetic engineering in this capacity has only been around for 30 years, and that it is important to continue evaluating the potential uses of GM crops.

One issue that may hinder the continued evaluation of GM technology is public opinion. Many have raised serious concerns about how mandatory labeling of GMOs could affect continuing biotechnology development in agriculture. Requiring all GMOs to be labeled could promulgate the idea that GMOs are innately unsafe and dangerous and could start to circulate around the general public and GMO could be unfairly targeted. This effect can be seen in a poll done by *The New York Times*, in which 93% of individuals interviewed were in support of mandatory labeling of GMOs. Since public opinion shapes policy, the current views could thwart the discovery of new GM technologies. All major presidential candidates, with the exception of Bernie Sanders, are actually against labeling GMOs. With this divide between the candidates and the public, do not be surprised to see GMOs show up in debates and on ballot next November. 🐾

# Pregnancy Plights

*Stress during pregnancy leads to lower reproductive success in Asian elephants*



by Savannah N. Miller

There's an ongoing debate on whether life begins at conception or after birth, but according to a study published in *Nature* by Hannah Mumby and colleagues, parenthood and childcare begins long before the offspring is even born. The behavior and life factors that affect elephant mothers have been shown to correlate with reproductive foibles in offspring later in life. In elephant populations, calves born into the high stress seasons reproductively developed earlier than their peers born in calmer conditions. Furthermore, those that developed earlier also had less reproductive success over their lifetime. Why is this the case, though?

**“...calves born into the high stress seasons reproductively developed earlier than their peers born in calmer conditions.”**

In this study, *Elephas maximus*, better known as Asian elephants, employed in the Myanmar timber industry were studied to determine how variation in lifestyle and routine affected their young. Researchers chose to focus on elephants because they live such long lives, upwards of 80 years, which can be comparable to human life spans. The study measured stress levels by taking fecal samples of sexually mature females. The amount of stress was indicated by the concentration of glucocorticoid metabolites in the fecal matter; these are molecules that are found in high concentration when the body is under stress.



Glucocorticoid metabolites in older, non-pregnant, non-lactating females were studied for a year. The stress-indicating molecules were found to be in the highest concentration in fecal matter during the June, July, and August, also known as the “high stress months.” Birth rates plummet at peak stress times, and when offspring were born in these months they had fewer chances of survival compared with those who were born during calmer periods throughout the year. The mothers have higher concentrations of these metabolites during peak stress months because their bodies are the most energetically challenged during this time. Talk about blaming mom for ruining your life.

Mothers in this timber industry are sometimes not determined to be pregnant until a year into the two-year gestation period, or length of pregnancy. This means they will continue to work in high stress environments until their handlers pull them out of work. In natural environments, elephants would probably not be inclined to mate during peak stress times due to behavior modification via natural selection. When the elephants don't conceive during high stress season, their offspring are not born into high stress months, and thus not subjected to unnecessary traumas. Less stress means greater reproductive success.

Though elephants and humans are only distantly related, the mechanisms behind these metabolic anomalies in elephants can still be applied to pregnant human mothers and their children. Because our life spans are similar in length, our life cycles sync up fairly well with elephants'. Though we, as humans, are often engrossed in our day-to-day lives, with jobs, school, and families to worry about, we should remember that other animals undergo stress, too. Through studies like this one, we can learn a great deal from their behavior and apply it to human behavior accordingly. 🐾



# Too Cute to Die

*One rodent's struggle against politics and climate change*



by Annie Carew

Before you read any further, you should Google pictures of the American Pika. It looks like a fluffy, adorable mix of a rabbit and a mouse. It is arguably the cutest rodent in existence. And it will be in serious danger of extinction as climate change progresses.

The American Pika inhabits high alpine regions in the American West. They can be difficult to detect, as their fur blends in with the rocks, and they are small and reclusive. The American Pika's range—the area in which it is found—includes mountaintops in California, Colorado, Oregon, Washington, Idaho, Montana, Nevada, and New Mexico, as well as western Canada. Pikas are well-adapted to cold high-altitude climates; their small, round bodies and thick fur conserve heat, and they have fur on their paws to provide traction on snow.

Unfortunately, these adaptations also mean that Pikas can die when exposed to temperatures of 78°F or higher. As the planet emerged from its last Ice Age, the Pikas' range began to shrink upslope because temperatures warmed. The Pikas flee the heat by climbing up the mountains, but populations become isolated and trapped on mountaintops, since they cannot venture into lower elevations in order to migrate to more favorable locations. With the impending threat of climate change, the rate of habitat loss for the Pika is expected to increase. And since they cannot survive warmer temperatures, they have no way of moving from one mountaintop to another in search of more suitable habitat. They are essentially trapped, isolated on islands of cool climate in a rising sea of heat.

The plight of the Pika has not gone unnoted by biologists. Erik Beever published a study in the *Journal of Mammalogy* in 2003 noting shrinking populations of Pikas in the Great Basin, which includes most of Nevada, half of Utah, and smaller areas of Oregon, California, Idaho, and Wyoming. In the Great Basin, Pikas have disappeared from thirty-two percent of mountainous habitats where they were documented in the early 1900s. Most of this loss has occurred at the southern end of the Pikas' range as a result of climate change.

Despite the threats to the American Pikas' habitat and life, it is not considered an endangered species. The International Union for the Conservation of Nature (IUCN) does not include the Pika on its infamous Red List of endangered species. In fact, the American Pika is listed as a species of "least concern." The US Fish and Wildlife Service (USFWS) and the California Fish and Game Commission have also ruled not to list the species as threatened. The justification for this is valid; the Pika is doing just fine in the northern parts of its range. The disappearing populations noted in the Great Basin represent a very small fraction of the overall species population. However, if global warming continues on its current trend, the American Pika will be in serious danger of going extinct in the United States. 🐾



# Feminine Suburbia

*Suburbanization, estrogen contamination, and sex ratio in wild amphibian populations*



by Richard Melton

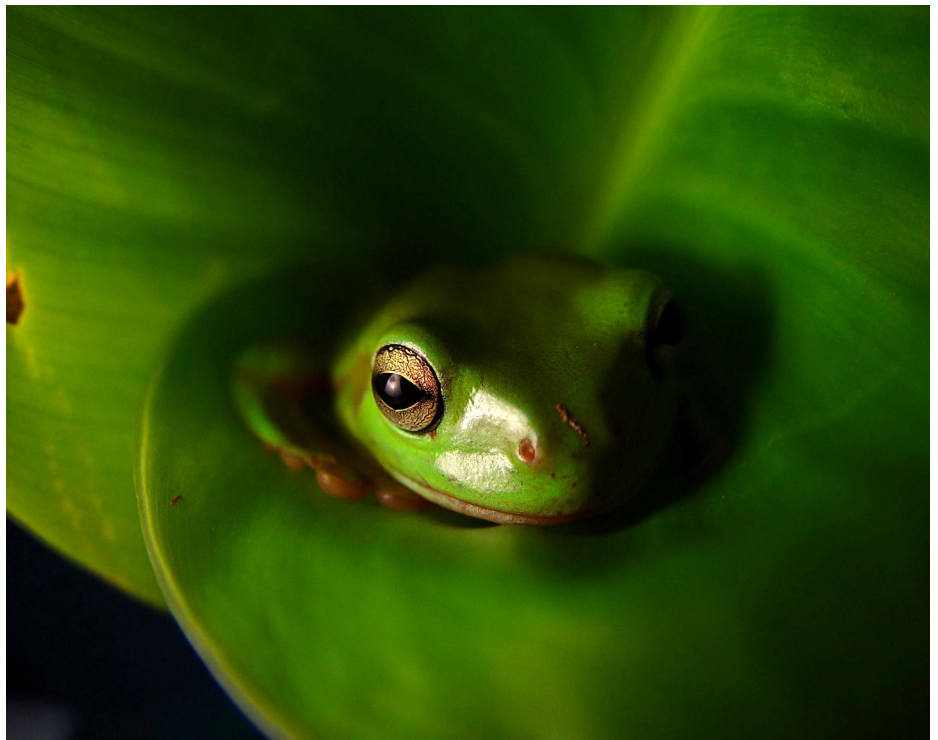
Anyone who has seen Jurassic Park knows that, given certain conditions, some species of frogs can change from male to female. This process is known as the feminization of a population. This happens in nature when a frog population has a low number of females. In response, certain male individuals change sexes. Past studies have shown that agricultural areas where certain pesticides, such as atrazine, are used cause an increase in the frequency of the feminization process. This is due to the pesticides releasing endocrine disrupting chemicals (EDC) in the environment. These chemicals are chemicals that disrupt the reproductive system of organisms by changing the hormone pathways that determine the sex of an individual. A study published in *Proceedings of the National Academy of Sciences*, suggests that factors present in suburban areas also cause an increase in EDCs and thus increasing the rate of feminization in Green Frogs (*Rana clamitans*) populations. Though the specific causes are unknown the data shows and clear increase in feminization along the suburban gradient.

**“...data shows that there is an increase in feminization rate among suburban populations...”**

The first step taken by the research team was to determine if there was in fact a difference in the feminization rates between suburban and underdeveloped ponds; their data show that there is an increase in feminization rate among suburban populations, a rather ubiquitous one at that. These data coupled with previous tests show that frog sex ratios change with the introduction of estrogen in a controlled environment and that sex determination in these frog species is not entirely genetic. This suggests that there is something in the environment causing an increase in the rate of feminization process. The researchers also took

chemical samples from the ponds and the land surrounding them to determine what correlations could be found. As expected, the suburban lands had high levels of EDCs and the ponds had especially high amounts of estrogen present than the underdeveloped ponds.

Jurassic park gave us a fictional example of how this process could present a problem, but this is anything but a fictional problem. Further study is needed to determine the long-term effects of increases feminization as well as potential implications of human populations, but the first step to solving a problem is discovering the issue, so this is an important step in finding a solution. 🐾





# Frozen in Debate

*Oil drilling in the Arctic may be economically beneficial but environmentally harmful*



by Annie Carew

At the end of September, Shell ceased offshore oil drilling in the Arctic, after nearly three years and seven billion dollars of effort. The company has stated that oil reserves in the area were not worth the monetary investment. Environmentalists are celebrating the news, while economists are worried about how Alaska will fare when the corporation withdraws.

In 2010, the BP offshore oil rig Deepwater Horizon spilled millions of gallons of oil into the Gulf of Mexico. In 2015, three Exxon rigs off the coast of California experienced a similar accident that leaked over 100,000 gallons of oil into the

from offshore Alaska residents off their coast. environment, it is financially up. Microscopic ocean for years, eventually fish

**“Oil spills are detrimental to the environment, and their effects last long after it is financially feasible to continue cleaning up.”**

instability of the Arctic Ocean, which is covered in ice for most of the year, further discouraged the presence of oil rigs. Offshore oil rigs are expensive and difficult to maintain when access is easy year-round; in a region like the Arctic, where the entire ocean is covered with a layer of ice in the winter, such maintenance would be impossible, and the likelihood of an accident would increase.

A study published by the Brookings Energy Security Initiative suggests that Alaska’s current government and infrastructure are not equipped to handle an oil spill. This may be part of the reasons for Shell’s withdrawal; if a spill were to occur, there is not adequate support for a proper cleanup. However, the study asserts that if these systems were strengthened, then drilling in the Arctic might become safer. No suggestions were made for how this could be accomplished.

Economists are concerned about the impact that Shell’s withdrawal will have on Alaska’s struggling economy, which is largely oil dependent. Shell has several thousand contract employees in Alaska, and these people will be out of a job now that Shell’s activity in Alaska has ceased. Shell’s presence in the Arctic was experimental; there was only one operating drill in the Arctic. If the operation had been deemed successful, Shell could have bolstered Alaska’s economy by providing jobs.

The cessation of offshore oil drilling in the Arctic is a mixed bag. While the local economy will most likely suffer, the environmental benefits are undeniable. Should Shell have continued offshore drilling despite the risk to the fragile ecosystem? As with most environmental issues, the answer is neither simple nor easy. 🐾

ocean. The threat of spills rigs was a source of fear for as long as Shell was working Oil spills are detrimental to the and their effects last long after feasible to continue cleaning oil droplets can linger in the affecting microorganisms and and marine mammals. The





# Biographies



**Annie Carew** is a senior majoring in Environmental and Natural Resources with a concentration in Conservation Biology. She is a member of the Presbyterian Student Association, the National Wildlife Society, and the League of Reliable Acquaintances. In the summer of 2015, Annie conducted research in Montana as one of Clemson's Prairie Ecology Fellows. She is the proud owner of a cat named Elliott who likes to play tag indoors. After graduation, Annie hopes to study wetland bird ecology.



**Hannah Halusker** is a junior genetics major from Spartanburg, South Carolina. She is a member of the FIRST program for first-generation college students, and she is involved in a Creative Inquiry that promotes an interest in science by teaching molecular biology techniques to high school students. When she has down time, she enjoys running, watching Netflix, cooking, and sleeping. After graduation, Hannah plans to take a mental health break before pursuing a career in genetic research or education.



**Maggie Masterson** is a junior genetics major, psychology minor from Norwell, Massachusetts. She is a member of the Clemson University Tiger Band and a volunteer at the Oconee Humane Society. Her hobbies include writing poetry and playing the clarinet. Maggie is an avid cat lover, and the proud owner of a tuxedo cat named Hoax. After graduation she plans on becoming a genetics counselor for cancer patients.

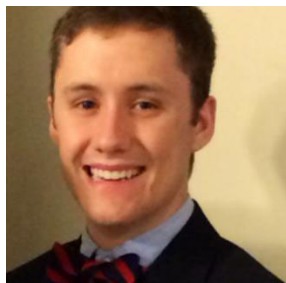


**Richard Melton** is a sophomore Biological Sciences major from North Augusta, South Carolina. Growing up as the son of a science teacher sparked his early love and appreciation for biology. He has worked as an intern in an aquatic research lab studying aquatic insects. After his education at Clemson, Richard plans on attending a graduate program for a Ph.D. in Evolutionary Biology, and he hopes to pursue research opportunities thereafter. His hobbies include playing video games and listening to music.

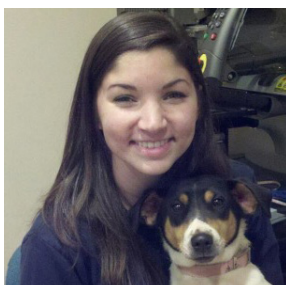


**Savannah N. Miller** is a senior Biological Sciences major from Mount Pleasant, South Carolina. She is a member of the Calhoun Honors College, Social Chair of the Women's Club Volleyball Team, Staff Writer for *The Black Sheep* satirical newspaper, Photo Editor of *The Tiger* newspaper, and a teaching assistant in anatomy lab. She loves puppies more than most things. After Clemson, she will attend the Medical University of South Carolina's College of Pharmacy as a Doctor of Pharmacy candidate.

# Biographies



**Charles Simmons** is a junior genetics major from Pickens, South Carolina. He is a member of Lukasz Kozubowski's research lab, EPIC (Eukaryotic Pathogens Innovation Center) Scholars, Alpha Epsilon Delta, and the Genetics & Biochemistry Club. He also volunteers as a tutor for local middle and high school students. During his free time, he enjoys working out, playing intramural sports, and watching Clemson football. After graduation, Charles plans to attend dental school in hopes of becoming an oral surgeon.



**Alex Villano** is a senior Biological Sciences major from Pickens, South Carolina. She is a member of the National Society of Collegiate Scholars, the Alpha Lambda Delta Honors Society, and the Sigma Alpha Lambda Honors Society. Her hobbies include spending time with her daughter, kayaking, and event planning. After graduation, Alex plans to spend a year investigating the field of biology and then pursuing a graduate degree.



**Dr. Lesly A. Temesvari** is an Alumni Distinguished Professor in the Department of Biological Sciences. She received her BS in Microbiology and Immunology from McGill University (Montreal, Canada) and her PhD in Biological Sciences from the University of Windsor (Windsor, Canada). She completed post-doctoral work at the LSU Health Sciences Center (Shreveport, LA) before joining the Clemson faculty 17 years ago. Her research focuses on characterizing virulence in the dysentery-causing human parasite, *Entamoeba histolytica*. Her research is funded by two grants from the National Institutes of Health.



**Dr. Steven B. Katz** is the R. Roy and Marnie Pearce Professor of Professional Communication, and Professor of English, at Clemson University. He is also a Fellow of the Robert J. Rutland Institute for Ethics. Before coming to Clemson in 2006, Dr. Katz was a Full Professor in the Department of English at NC State University. Dr. Katz received his Ph.D. in Communication and Rhetoric in 1988 from Rensselaer Polytechnic Institute, where he studied intersections and impacts of language, technology, science, and ethics. One focal point of his research is scientific communication, about which he co-authored (with Ann Penrose) *Writing in the Sciences: Exploring Conventions of Scientific Discourse* (3e, 2010). He is particularly concerned with scientific communication for general publics, which is crucial for a literate democracy.



**Jan Lay** is the Adobe Trainer for CCIT and an instructor (Adobe Design Skills) for CAFLS. Her background includes freelance scientific illustration and a Master's in Stream Ecology. When not working, Jan enjoys hiking, collecting edible wild mushrooms, creating detailed mosaics, going to music festivals and contra dancing.

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